

ANSWERS OF TUTORIAL PROBLEMS

Tutorial 1

Q.1) $\underline{M}_B^R = -38.4 \underline{k}$ N-m; $-240x - 320y = -38.4$; $y = 0.12\text{m}$; $x = 0.16\text{m}$; $y = -0.06\text{m}$

Q.2) $T_{AB} = 2758.25$ N; $T_{AC} = 3510$ N

Q.3) $\underline{R} = -325 \underline{j}$; $x = -0.9231\text{m}$; $z = -0.6154\text{m}$

Q.4) $h = 4.5$ m

Q.5) $\underline{R} = -200 \underline{j}$; $\bar{Z} = 2.6$ m; $\bar{X} = -0.9$ m

Q.6) $R = 95977.5$ N acting at 0.49574 m from bottom of the door

Tutorial 2

Q.1) $F_s = -225$ N; $D_x = 159.1$ N; $D_y = -459.1$ N

Q.2) $R_C = -259.81$ N; $R_B = 519.62$ N; $T = 150$ N

Q.3) $B_x = -630$ N; $B_y = -30$ N; $C_x = -630$ N; $C_y = 516$ N

Q.4) $P = 80$ N

Q.5) $F_{HE} = 22.36$ kN; $F_{BE} = 12.5$ kN (T)

Q.6) Pressure in each piston, $p = 2.084$ N/mm²

Tutorial 3

Q.1) $T = 1292.35$ N

Q.2) $T_{CD} = 1.5$ kN, $T_{BD} = 2.175$ kN, $T_{BE} = 3.9601$ kN

Q.3) $D_x = 375$ N

Q.4) $(-4, 1, 0)$; $T_{\min} = 300$ N

Tutorial 4

Q.1) $F_{FH} = 160$ kN (C); $F_{EH} = 200$ kN (T); $F_{EG} = 0$; $F_{LM} = 80$ kN (T); $F_{MK} = 100$ kN (C);
 $F_{LK} = 120$ kN (C)

Q.2) $F_{DE} = 180$ kN (T), $F_{BD} = 180$ kN (T)

Q.3) $F_{AB} = F_{BC} = 0$, $F_{AD} = 32.71$ kN (C); $F_{AE} = 68.11$ kN (T), $F_{EF} = 70$ kN (C), $F_{BF} = 0$

Tutorial 5

Q.1) $h = 0.2477$ m

Q.2) $\text{Min } \mu_s = 0.178$

Q.3) $F = 408.75$ N

Q.4) $21.801^\circ < \theta < 62.85^\circ$

Tutorial 6

Q.1) $M = 5.4167$ N-m

Q.2) $M = 0.006837P$ N-m

Q.3) $T = 181.15$ N

Q.4) $M = 234.95$ N-m

Q.5) $M = 91.316 \text{ N-m}$; $\mu = 0.5123$

Tutorial 7

Q.1) $P = \frac{W \cot \theta}{2}$

Q.2) $\frac{P}{Q} = \frac{(l_1 + l_2) \tan \theta}{l_1}$

Q.3) $W = 2769.7 \text{ N}$

Q.4) $F_C = 3164.5 \text{ KN}$

Tutorial 8

Q.1) $\theta = 19.221^\circ$

Q.2) $\delta_c = 20.833 \text{ mm downwards}$

Q.3) $W < 1000 \text{ N}$

Q.4) $M = \frac{PR}{\sin^2 \theta}$

Tutorial 9

Q.1) $k = 763 \text{ N/m}$; $k = 2912.4 \text{ N/m}$

Q.2) $T_n = 0.49618 \text{ sec}$; $(V_A)_{\max} = 0.227935 \text{ m/sec}$

Q.3) $\omega_n = \sqrt{\frac{mg \frac{l}{2} + Mg \left(l + \frac{D}{2} \right)}{\frac{ml^2}{3} + MI^2 + MID + \frac{7}{5} \frac{MD^2}{4}}}$

Q.4) $\omega_n = \sqrt{\frac{2kr^2}{\frac{MR^2}{2} + \frac{WR^2}{g}}}$

Q.5) $P = 33970 \text{ N}$

Q.6) $\omega_n = 4.402 \text{ rad/sec}$; $C = 0.002271 \text{ rad}$

Tutorial 10

Q.1) $T_n = 2\pi \sqrt{\frac{m}{6k}}$; $\zeta = \frac{3c}{\sqrt{6km}}$

Q.2) $0.23 \ddot{\theta} + 0.32 \dot{\theta} + 4.4905\theta = 0$; $T_n = 1.422 \text{ sec}$; $\zeta = 0.1574$; $T_D = 1.4399 \text{ sec}$

$0.20 \ddot{\theta} + 0.32 \dot{\theta} + 4.0000\theta = 0$; $T_n = 1.405 \text{ sec}$; $\zeta = 0.1789$; $T_D = 1.4280 \text{ sec}$

Q.3) $\omega_D = 6.5291 \text{ rad/sec}$, $\dot{\theta}_{\max} = -3.4861 \text{ rad/sec}$, $\theta = 8.5355 \text{ E-08 rad}$

Q.4) $T_n = 0.49618 \text{ sec}$; $V_{\max} = -226.7859 \text{ mm/sec}$; $\zeta = 0.0032265$; $c = 0.16721 \text{ N-sec/m}$